

Section VI – Technical Specifications

ITEM VIII - DUPLEX SEWAGE PUMPING STATIONS AND PIPING

8.01 Scope

- (a) Submersible sewage pumping stations shall consist essentially of three submersible sewage pumps (two installed, one spare), guide rails, access frames and covers, control panel, wet well structure, valve pit, fencing, yard hydrant, yard light, access road and piping.

Design Basis: Each pump must have the necessary characteristics and be properly selected and designed to perform under operating conditions shown on the pump station drawings. Pumps provided shall be delivered pre-adjusted to meet the specified conditions.

- (b) Preparation and grading of site and excavation; manholes; concrete; valves and piping; and grassing and planting shall conform to the requirements of other sections of these specifications.

8.02 General

- (a) Pumps, piping and other equipment shall be new and unused, designed for the service intended, and shall be suitable for installation and efficient operation within the space and under the conditions shown on the plans and specified herein. All equipment shall be properly protected so that no damage, deterioration, or corrosion will occur during shipment or storage. Control panels with corrosion or component corrosion will be rejected.
- (b) The Contractor shall furnish the services of a competent engineering representative of the manufacturer of the pumps to inspect their installation and supervise initial operation. Upon completion of such supervision, the manufacturer's representative shall provide the Engineer with a signed certificate which states that the pumps have been checked; that they perform satisfactorily; and that they meet the requirements of the specifications. This certificate shall show the name of the pump manufacturer and the name of the company or firm by which the representative is employed.
- (c) The Contractor shall furnish to the Engineer six (6) copies of drawings of equipment to be furnished; foundation plans, number and position of all anchor bolts, manufacturer's specifications descriptive literature, complete electrical data and control diagrams, and operating and maintenance manuals. Six (6) copies of performance curves shall also be furnished for the pumping equipment, showing the condition point, shut-off head, the impeller diameter, the pump speed, and the horsepower. The net positive suction head required (NPSHR) for each pump shall also be provided. Descriptive literature and operating and maintenance

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manuals shall be furnished at the same time equipment drawings are furnished. This material shall be furnished in suitable binders.

8.03 Spare Parts

The manufacturer shall furnish a complete set of spare parts to include at least the following for each pump:

One spare pump mechanical seal (complete), and with it all gaskets, seals, sleeves, o-rings, and packings required for replacement of the seal.

8.04 Warranties

The pumps shall be warranted to be free from defects in workmanship, design, and materials for a period of five (5) years under normal use, operations, and service.

The pump mechanical seals, rotor, stator, impeller, pump housing and ball bearings shall be warranted for a minimum of five (5) years from the date of shipment. Should the materials fail within the first year, the manufacturer shall be obligated, upon notification, to furnish new materials, without charge to the Owner. The cost of replacement materials (as listed above) thereafter will be on a pro-rated basis as follows:

Months After Shipment	Percentage of New Material Price
0-18	0%
19-31	25%
32-45	50%
46-60	75%

8.05 Submersible Sewage Pumps

- (a) Furnish three (3) submersible non-clog wastewater pumps. Install two pumps in the wet well and provide one pump as a spare. Each pump shall be equipped with a submersible electric motor connected for operation on ____ V, three phase, 60 Hz. wire service. The pumps shall be ABS model _____ submersible pumps running at _____ RPM, or Ebara Model _____, or Flygt Model _____. Each pump shall be rated for a discharge of _____ GPM at _____ feet TDH with a minimum efficiency of _____ at the operating point. An additional point on the same curve shall be _____ GPM at a TDH of _____ feet (minimum). The shut off head shall be _____ feet TDH

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minimum. The pumps shall be designed to pump raw, unscreened sewage, storm water, and other fibrous pumpage without damage during operation. The pumps shall be capable of passing a three inch diameter sphere without damage to the pump or clogging of the pump. The pumps shall be designed such that the pump shaft horsepower (BHP) shall not exceed the motor rated horsepower throughout the entire operating range of the pump performance curve. The pumps shall be automatically and firmly connected to a mating discharge connection, guided by stainless steel guide bars or rails extending from the top of the station to the discharge connection. Positive sealing of the pump to the discharge elbow shall be accomplished by a field replaceable rubber gasket mechanically held in place between the pump and the sliding guide bracket. Each pump shall be fitted and equipped with a sufficient length of stainless steel lifting chain suitable for a rated working load of at least 50% greater than the pump unit weight. There shall be no need for personnel to enter the wet well.

- (b) Major pump components shall be of gray cast iron, ASTM A48, Class 40 with smooth surfaces, free of blow holes, or other irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel. All metal surfaces coming into contact with the pumped media (other than the stainless steel components) shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a high solids two part epoxy paint finish on the exterior of the pump.

Sealing design for the pump/motor assembly shall incorporate metal to metal contact between machined surfaces. Critical mating surfaces where a watertight seal is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without requiring a specific torque limit. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered equal. No secondary sealing compounds shall be used.

- (1) The impeller shall be of grey cast iron, ASTM A48, Class 40, dynamically balanced, semi open, non clogging design having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in wastewater. Whenever possible a full vaned impeller shall be used for maximum hydraulic efficiency. The impeller shall have a slip fit into the motor shaft and drive key, and shall be fastened to the shaft by a stainless steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly. The impeller shall be capable of passing a three inch diameter sphere.
- (2) Pump volute shall be grey cast iron, ASTM A48, Class 40, non-concentric design with smooth passages large enough to pass any

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solids that may enter the impeller. The minimum discharge size shall be _____ inches. The discharge flange shall permit attachment to standard ANSI or DIN flanges/appurtenances.

- (3) Wear rings shall be used to provide an efficient seal between the impeller, and the volute. The wear ring shall be stationary and made of stainless steel. The wear ring shall be drive fitted to the volute inlet. An adjustable, self cleaning wear plate constructed from gray cast iron, ASTM A-48, Class 40 may be used in lieu of wear rings.
- (c) Each pump shall be furnished with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an oil reservoir that hydrodynamically lubricates the lapped seal faces at a consistent rate. The lower, primary seal unit, located between the pump and oil chamber shall contain one stationary and one positively driven ring made up of silicon-carbide. The upper, secondary seal unit, located between the oil chamber and the motor housing shall contain one stationary carbon seal ring and one rotating corrosion resistant Cr-steel seal ring. Each seal interface shall be held in place by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to prevent overfilling and to provide oil expansion capacity. The drain and inspection plug shall be readily accessible from the outside and shall be provided with a positive anti leak seal. The seal system shall not rely on pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.
 - (d) The pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be AISI type 420 stainless steel.
 - (e) The pump shaft shall rotate on upper and lower bearings. Motor bearings shall be permanently grease lubricated. The calculated B10 bearing life rating shall be 50,000 hours minimum. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces.
 - (f) The pump motor housing shall be gray cast iron, ASTM A48, Class 40. The motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 311 degrees F(155 degrees C). The stator shall be dipped and baked three times in Class F varnish and shall be head shrink fitted into the stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling

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pumped media of 40°C (104 °F) and capable of handling up to 12 evenly spaced starts per hour. The service factor (as defined by NEMA) shall be a minimum of 1.10. The motor shall have a voltage tolerance of +/- 10% from nominal. A performance chart shall be provided upon request showing curves for torque, current, power factor, input kW, output HP and efficiency. This chart shall also include data on starting and no-load characteristics.

- (g) The rotor bars and short circuit rings shall be made of cast aluminum. The motor shall be designed for continuous duty, completely submerged or unsubmerged.
- (h) Each phase of the motor shall contain a bi-metallic temperature monitor in the upper portion of the stator windings. These thermal switches shall be connected in series and set to open at 140°C +/- 5°C. They shall be connected to the control panel, and used in conjunction with and supplemental to external motor overload protection. Thermal switches when opened shall stop the motor and activate an alarm.
- (i) An electrical probe shall be provided in the oil chamber for detecting the presence of water in the oil chamber. A solid-state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber, the probe shall signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel, and cause the pump to be shut down. Float switches, dual probes, or any other monitoring devices located in the stator housing are not considered to be early warning systems, and shall not be considered equal.
- (j) The power cables shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the control panel without requiring splices. The outer jacket of the cable shall be oil resistant chloroprene rubber, and shall be capable of continuous submerged operation underwater to a depth of 65 feet.
- (k) The cable entry design shall not require specific torque requirements to insure a watertight seal. The cable entry shall consist of a cylindrical elastomer grommet, flanked by stainless steel washers. A cable cap incorporating a strain relief shall mount to the cable entry boss compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry.
- (l) The motor horsepower shall be adequate such that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.
- (m) Electrical work and controls shall be installed in accordance with the shop drawings and the manufacturer's recommendations for the equipment supplied. All electrical work shall be subject to the provisions of the NEC and shall be installed by licensed personnel.

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- (n) The guiderail assembly for the pumps shall be ABS guiderail number _____, or Ebara number _____, or Flygt number _____. The guiderails shall be constructed of stainless steel.

8.06 Surge Protection

- (a) A surge protective device shall be connected so each phase is provided a 160,000 amp surge current rating, LED indication lights per phase, and integral fused disconnect. The device shall be PTX-160 as manufactured by Eaton Innovative Technology in a NEMA 4X stainless steel enclosure or pre-approved equal.

8.07 Pump Control Panel

- (a) The pump control panel as shown on the drawings and as specified herein shall be capable of the operation of two submersible pumps as specified.
- (b) The enclosure shall be NEMA 4X Type 316 Stainless Steel and mounted as shown on the plans. The enclosure shall have a single three-point stainless steel padlockable latch and stainless steel welded dripshield. Screw-type latches or wall mounting through the enclosure will not be accepted. The enclosure shall be fully gasketed and equipped with stainless steel gasket retainers.
- (c) The enclosure shall be equipped with a removable hinged inner door constructed of minimum 0.09” 5052 H-32 marine alloy aluminum. A minimum of the following components shall be installed on the aluminum inner door:
- (1) Hand-Off-Automatic (HOA) selector switches for pumps shall be non-spring loaded and oil tight.
 - (2) Six digit elapsed time meter (non-resettable) for each pump.
 - (3) Ammeters with Off-L1-L2-L3 selector switches, with appropriate scale ranges. One ammeter for each pump motor.
 - (4) The following indicating lamps:

Pump Running (green)
Seal Failure (amber)
Motor failure for over temperature, pump breaker trip, or starter overload trip (amber)
- Lamps shall be latching until the reset button is pressed.

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- (5) Pushbuttons for:
 - Alarm Horn Silence (externally mounted)
 - Reset for Motor Failure
 - Alarm test button
 - Alarm Reset button
 - (6) Pilot devices shall be heavy-duty 30 mm NEMA 4X, Square D type SK.
 - (7) A 20 amp, 110 volt GFCI duplex receptacle mounted on inner door.
 - (8) An On-Off switch shall be provided for control of a remote mounted yard light.
 - (9) All door-mounted components shall have engraved nameplates (Three-ply laminated plastic; white letters, black background).
- (d) Controls shall be mounted on a removable sub-panel using stainless steel machine screws (self-tapping screws are not acceptable). A minimum of the following components shall be mounted on the back plate:
- (1) Main and Emergency breakers with walking beam mechanical interlock shall be manufactured by Square D. Breakers shall be accessible and operable through inner door without need for opening the inner door.
 - (2) Medium-duty pump motor circuit breakers to be manufactured by Square D. Pump breakers shall be accessible through inner door.
 - (3) NEMA rated motor starters equipped with heavy-duty industrial contactors (definite purpose contactors are not acceptable) and non-adjustable bimetal overload protection. Starter sizes “0” or “00” are not permitted.

Reduced voltage (soft start) starters shall be used for pump motor sizes 25 HP or greater. The City Engineer shall be consulted concerning the use of variable frequency drives for motor sizes 25 HP or greater.
 - (4) Capacitors shall be incorporated into the panel when single-phase power is provided.
 - (5) Current transformers shall be provided for each power leg of the pumps to monitor current level.

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- (6) Circuit breakers shall be provided as follows:
- Main Disconnect (Cuts all power to control panel)
 - Control Power Breaker
 - Separate Breaker for each Pump Starter
 - GFCI receptacle
 - Yard light
 - Telemetry power
- (7) A control circuit transformer shall be included to provide 115 VAC power to control components. Fuses selected according to NEC requirements shall protect transformer primary and secondary. Fuse blocks shall be provided with lights for indication of a blown fuse.
- (8) A surge capacitor with fuses shall also be provided for protection of the panel.
- (10) Phase failure relay shall be plug-in pin type and fuses and will monitor:
- Phase failure
 - Phase reversal
 - Low voltage (Brown outs)
- (11) Automatic electrical alternator shall be Diversified ARA120ABA.
- (12) Control relays shall be plug-in blade type with indicator light. Square D type KU or Allen Bradley.
- (13) Seal failure relays shall be the electronic plug-in pin type with indicator light as manufactured by Warrick Controls.
- (14) Power terminals and control terminals shall have minimum 1/4" flat head set screws.
- (15) Spare terminals shall be provided for:
- Pump running
 - Pump seal failure
 - High level
 - Power failure

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- (16) Omni – Site XR-50 Cellular monitoring system shall be installed in the pump control panel and wired to monitor the following items:

High Level Alarm
Pump Run Times
Phase Loss
Power Loss

Or TAC Pack as specified below (System to be determined by City Engineer)

- (16) TAC Pack Telemetry Control Unit as manufactured by Data Flow Systems of Melbourne, Florida. Unit shall be configured so that radio unit can be added at a later time without any control panel modifications other than installation of radio module and necessary radio antennae wiring. Unit shall be used for telemetry monitor and control only. Unit shall not be used as a primary pump control device which would allow for the elimination of duplicated “hardwire” components listed elsewhere in this specification. The local control of the pumps shall function normally even when the Unit is not functioning properly. The Unit shall be supplied with all software and special cables necessary to communicate with the unit through the RS-232 service port from a PC or Laptop Computer.

- (17) A 50 watt condensation heater and thermostat.

- (e) A weather proof alarm horn, 115 VAC, vibrating type and flashing alarm light, with a minimum of 40 watt light bulb shall be installed on the side of the panel.
- (f) All installations requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panels NEMA rating. Panels shall be factory assembled and shall bear a UL approved label certifying this rating. Alarm light and horn shall be on at high water level.
- (g) The enclosure shall be equipped with an Appleton AJA (NEMA 4X) mounting box and receptacle for emergency generator power. The receptacle shall be 4 wire, 4 pole, style 1, Model Appleton ADR20044RS.
- (h) Control sequence shall function as follows:

When wastewater level in the wet well reaches the ‘lead float’ level, the lead pump starts. If fluid recedes to the off level, the pump shuts off, if not, fluid will continue to rise until it reaches the ‘lag float’ level where the lag pump will begin to operate. Both pumps will operate until the fluid in the wet well returns to the off level where both pumps shut off. At each instance when the off float is activated (in automatic mode), the alternator automatically reverses the sequence

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of pump operation allowing for equal usage of the pumps. If one of the pumps is in the off position, it shall be removed from the alternation sequence as if the pump performs as a simplex controller.

If level continues to rise to high level, the alarm light will flash and horn will sound until alarm silence reset button is pressed.

When the wetwell is below a predetermined level, there shall be an alarm indicating low water level and all pumps shall be locked out from operation in either the hand or automatic position until the wetwell level reaches at least the lead pump on level which shall unlock the pumps to operate. The low level alarm however will not reset until the reset button is pushed.

In the HAND position the selected pump will operate independently from the alteration sequence but will not run if the wetwell is below the low level alarm elevation.

Upon resuming power after a power failure or in a high level alarm condition, the pumps will be provided with an automatic staggered restart of the equipment with a field adjustable time from 1 second to 99 seconds.

Control sequence shall be designed so that panel functions automatically again after a power failure and manual reset is not necessary. The control sequence shall also be designed to allow operation of the lead float as off and the lag float as lead in the event of off float failure.

- (i) Control wire to be MTW 90 degree C, #14 AWG. Color code and number all wiring as indicated on the factory wiring diagram. All wiring shall be neatly grouped in plastic wire troughs except wiring from bookplate to the door shall be done in separate bundled harnesses. All wires shall have a wrap-around wire identification number at both ends of the wire as shown in the wiring diagram. All components shall be identified with the same number as shown in the wiring diagram.
- (j) Electrical schematic shall be plastic laminated and affixed inside the control panel door.
- (k) All conduits entering the control panels or other enclosures from the wet well shall be sealed with gas-tight fittings. (Meters type hubs). A junction box shall be located below the gas-tight seals for the pump and control conduits. Provide a minimum of three (3) 2" I.D. conduits from wet well to junction box and from junction box to the control panel. (See Detail).

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- (l) Control panel shall be the product of a manufacturer that is authorized by Underwriters Laboratories, Inc. to build products in compliance with L Standard 508A. A UL label shall be affixed to the completed control panel.
- (m) The pump control panel manufacturer shall have at least 15 years of experience and have at least 3000 similar installations. Control panel shall be 'N Series' as manufactured by Control Interface, Inc.; Cincinnati, OH or pre-approved equal.

8.08 Float Switches

A system of five mercury float switches shall be provided for control of pumps and alarms. Float switches shall be narrow angle internally weighted as manufactured by Conery or equal. The switches shall be single pole, single throw rated 10 amp @ 120 Vac. A single stainless steel bracket shall hold the float

switches. Electrical cable shall meet NEC standards. Cable shall be of sufficient length to reach control panel without splicing and to allow for adjustment. Separate floats shall be used for Low Alarm, Pump Off, Lead Pump On, Lag Pump On, and High Alarm. System shall be capable of automatically handling floats that are out of sequence.

8.09 Electrical Wiring/Miscellaneous Electrical Items

- (a) The electrical wiring shall consist of wiring work associated with a yard light, service entrance, main breaker, power wiring to pump control panel, power and control wiring to the pumps, grounding system and metering provisions as required by the electric utility. Wiring shall comply with requirements of the National Electrical Code, any state or local codes or ordinances, and the electric utility company. Materials shall be listed by Underwriters Laboratories and shall be new and delivered to the job in its original cartons. Conduits and fittings shall be NEMA rated PVC for the appropriate application and exposure. Power and control conductors shall be Class B stranded copper. Power conductors shall be minimum number 12 AWG Type RHH-RHW-USE meeting ICEA Standard S-68-516 or S-66-524. Control conductors shall be minimum No. 14 AWG Type THHN. Ground conductors shall be medium soft drawn, stranded copper meeting ASTM Standard B-8. Connectors and terminals shall be solderless compression or pressure type cast connectors. Below grade ground connections shall be exothermically welded. All wiring shall be run in conduit except pump power and control cords within wet well.
- (b) The yard light shall be a U.L. Listed, 70 Watt/120 Volt, heavy duty high pressure sodium light. The light shall be photo-controlled for automatic dusk to dawn

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operation. Provide light with die-cast aluminum housing suitable for outdoor mounting on a pressure treated wood power pole.

- (c) The main breaker shall be an enclosed circuit thermal-magnetic breaker, 3 pole, 600 volt, labeled as suitable for service equipment. The service shall be protected with a three pole secondary lightning arrestor connected directly to the grounding system.
- (d) Pump power cords and float switches shall be run from the wet well to the control panel underground in conduit. Conduits shall be sealed at wet well and at junction box mounted under control panel in such a manner that the seal may be removed from the conduit system when the wires must be removed for repair.
- (e) The grounding system shall consist of bare copper conductors, minimum No. 2 AWG, bonding together the pump rails, metallic piping, the utility company neutral conductor, and a driven $\frac{3}{4}$ "x 10' copper clad ground rod.
- (f) The Contractor shall coordinate the installation with the electric utility. The Contractor shall furnish and/or install metering provisions as required by the utility, verify service voltage, and include in his bid any charges from the utility for providing service to the station.

8.10 Wet Well and Valve Pit Piping, Valves, and Fittings

All Ductile Iron piping, valves, and fittings shall be ductile iron coated with Protecto 401 on the interior surfaces. The exterior surfaces of the piping, and fittings in the wet well shall be sprayed with the Raven Epoxy Lining used to line the concrete wet well. Pipe, valves, and fittings shall conform to Section III- Sanitary Sewer System Force Mains.

All bolts, nuts, washers, brackets, and hardware in wet well and valve pit shall be Type 316 stainless steel.

Exterior surface of valve pit piping, and fittings shall be coated with an exterior shop coating of red primer (Tnemec Series 1 Omnithane Primer, 3.0 dry mils). The second coat shall be 66-Color Hi-Build Epoxoline, 4.0 dry mils. The third coat shall be 104-Color H.S.Epoxy, 8.0 dry mils (semi-gloss finish).

8.11 Wet Well Structure

The wet well structure shall consist of a precast concrete manhole and top slab of the type and size shown on the plans. The precast manhole sections shall conform to the applicable requirements of the Manhole Specifications. The interior of the wet well shall be coated with Raven Epoxy Lining or pre-approved equal with a

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minimum thickness of 125 mils. The access frame shall be cast into the precast top slab. The access frame and cover shall be 3'-0" x 4'-0" and of the double door type as manufactured by Halliday Products (Model No. S1R3648) or equal. The doors shall be of checkered plate and rated at 150 psf.

8.12 Valve Pit Structure

The valve pit structure shall be a precast concrete vault with minimum 5'-0" x 5'-0" clear inside horizontal dimensions. The top slab shall be precast with the access frame cast into it. The access frame and cover shall be 4'-0" x 4'-0" and of the double door type as manufactured by Halliday Products (Model No. S2R4848) or equal. The doors shall be of checkered plate and rated at 150 psf.

8.13 Installation and Erection

- (a) Pumps and other equipment shall be erected and installed by competent, skilled mechanics at the exact positions and elevations shown on the plans.
- (b) The Contractor shall furnish all necessary oil and grease for the operation of the equipment during the initial trial operation.
- (c) Anchor bolts shall be type 304 stainless steel, accurately placed in the concrete foundations in their exact position and elevation by the use of templates, and all anchor bolt settings shall be carefully checked before concrete for the foundation is placed.
- (d) All equipment and connecting piping shall be installed in such manner that no load from the piping will be carried by the pumps.
- (e) The Contractor shall properly grout each piece of equipment after it has been carefully aligned and leveled with steel wedges. The grout shall be poured so as to completely fill the space between the bottom of the base of the equipment and the top of the foundation. Grout shall be a non-shrinking type.
- (f) After installation, all equipment shall be tested in a manner satisfactory to the Engineer and any defects or deficiencies found shall be corrected by the Contractor.

8.14 Water Service to Sewage Pump Stations

- (a) Water service to sewage pump station sites shall consist essentially of a 1" corporation stop, water service line, curb stop, water meter, cast iron meter box and cast iron solid cover, double check/reduced pressure backflow preventer, and yard hydrant.

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- (b) The method and type of tapping the existing water main, the meter, corporation stop, backflow preventer, meter box and couplings shall meet the requirements of the City of Cayce.
- (c) Water service pipe shall be polyethelene (PE) tubing as shown on the plans.

8.15 Sewage Pump Station Site Fencing

(a) General

Fencing fabric, posts, gates, and coordinating components shall be brown vinyl coated with the color as selected by the City.

(b) Fabric

- (1) The fabric shall be composed of 9 gauge steel wire helically wound to form a continuous chain link fabric having a 2-inch mesh. Top and bottom edges shall have a twisted and barbed finish. The fabric shall be manufactured in accordance with ASTM A-392.
- (2) Fabric shall be hot-dipped galvanized after weaving to produce a zinc coating not less in weight than 2.0 ounces per square foot of uncoated wire surface.
- (3) Wire in the fabric shall meet minimum breaking strength of 1,290 pounds after galvanizing.

(c) Line Posts

Line posts shall be 2-1/4x1-7/8 High Carbon H Beams hot galvanized (2 ounces per square foot). Posts to be spaced approximately 10 feet on centers and set a full 3 feet in concrete footings, crowned at the ground surface to shed water.

(d) End and Corner Posts

End and corner posts shall be standard hot galvanized (2 oz. per square foot) basic open hearth Copper-bearing steel pipe 3 inches O.D. weighing 5.79 pounds per foot, for setting a full 3 feet deep in concrete footings, crowned at the ground surface to shed water.

(e) Top Rail

Top rail shall be 1-5/8 O.D. standard pipe hot galvanized (2 oz. Per square foot) and shall be furnished in random lengths averaging not less than 20 feet, jointed with extra long pressed steel sleeves, hot galvanized, making a rigid connection

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but allowing for expansion and contraction.

(f) **End and Gate Post Tops**

End and gate post tops shall be galvanized malleable iron, drive fitting outside of post to exclude moisture.

(g) **Fabric ties**

Fabric ties for attaching fabric to line posts or top rail shall be aluminum strip or wire used on top rail every 24 inches and on line posts every 14 inches.

(h) **Barbed Wire**

The fabric shall be surmounted with 3 strands of barbed wire. Each strand shall consist of 2 (two) No. 12-1/2 W&M gauge twisted Copper-bearing steel line wires, Class 3, hot galvanized, with No. 14 W&M gauge, 4 point barbs spaced not more than 4 inches apart. The barbed wire shall be manufactured in accordance with ASTM A-121.

Barbed Wire Extensions: All intermediate, gate and corner posts shall be equipped with extension arms for supporting barbed wire. The base shall be malleable iron and the extension pressed steel hot galvanized after fabrication. Intermediate arm shall have provision for passing top rail and corner arm casting to have set screw.

(i) **Brace and Tension Bands**

Brace and tension bands shall be unclimbable beveled edge type with 3/8 inch diameter square shouldered aluminum carriage bolts, non-removable from outside fence.

(j) **Bracing**

All corner, gate and terminal posts shall be braced by means of 1-5/8 O.D. horizontal compression member, securely attached to terminal and to first line posts with malleable iron fittings, beveled edge bands, and truss braced from first line post to bottom of terminal by 1/2 inch rod and turnbuckle. Corner posts to be so braced in each direction.

(k) **Tension Bars**

Tension Bars for attaching fabric to terminal posts shall be 3/16x3/4 high carbon steel attached to terminal posts by means of beveled edge bands.

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(1) Entrance Gates

Provide one double-swing gate with a minimum 16'-0" wide total width aligned with the wetwell and one single swing "man" gate.

8.16 Access Road

Provide an all-weather stone access road (12' minimum width) to the entrance gate of the pump station. This road shall be maintained by the Owner until the project is accepted by the City.

END OF SECTION